

REMARKS

Claims 1-11 are pending. Claim 1 is the only independent claim. By the present amendment, claim 1 has been amended to even more clearly recite and distinctly claim the process of the present invention and to incorporate the subject matter of claim 10. Claim 10 has been correspondingly cancelled. Support for the amendments may be found at least in the original claims and in the specification at pages 3 and 8. Accordingly, no new matter has been added.

Applicants respectfully request that the Examiner reconsider and withdraw the outstanding rejections in view of the foregoing amendments and the following remarks.

Claim Rejections Under 35 U.S.C. § 103

Claims 1-3, 5 and 8-9 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Kuzmina et al. Applicants respectfully disagree with this rejection; therefore, this rejection is respectfully traversed.

Kuzmina et al. discloses preparation of *silver pivilate-diisopropylamine complexes* to prevent polymerization of silver pivilate. According to Kuzmina et al., diisopropylamine was introduced as a *molecule of neutral ligand into the coordination sphere of silver*. Solutions of such *silver pivilate-diisopropylamine complexes* in organic solvents are useful for chemical vapor deposition. Kuzmina et al. found that the complexes lost diisopropylamine over time resulting in the formation of silver pivilate, with its polymeric structure and associated, problematic thermal behavior. Sections 3.3 and 3.4.

In contrast, amended independent claim 1 recites a process for depositing a silver film on a substrate, comprising depositing silver on the substrate by chemical vapor deposition, *in an oxygen atmosphere or in a hydrogen atmosphere*, of a *solution comprising a silver precursor, an amine and/or a nitrile, and a solvent*, wherein: the silver precursor is a silver carboxylate RCO_2Ag in which R is a linear or branched alkyl radical that has 3 to 7 carbon atoms; the *concentration of the silver precursor in the solution is between 0.01 and 0.6 mol/l*; optionally the solvent has an evaporation temperature that is less than the decomposition temperature of the silver precursor; and the *percentage by volume of the amine and/or the nitrile in the solvent is more than 0.1%*.

A *prima facie* case of obviousness requires that each and every claim limitation be present in the cited reference or cited references when combined. M.P.E.P. § 2143.03. Moreover, there must be some teaching, suggestion, or motivation to combine elements of the prior art in the prior art itself, the nature of the problem, or the knowledge of a person with ordinary skill in the art. *KSR International Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1734 (2007). Finally, there must be a reasonable expectation of success in modifying or combining the elements of the prior art to arrive at the claimed invention. M.P.E.P. § 2143.02.

Applicants respectfully submit Kuzmina et al. does not disclose or suggest a *solution comprising a silver precursor, an amine and/or a nitrile, and a solvent* as recited in independent claim 1. As explained above, Kuzmina et al. is directed to chemical vapor deposition of a solution of *silver pivilate-diisopropylamine complexes* in an organic solvent.

In contrast, as presently claimed, the amine and/or nitrile is not complexed with the silver precursor. Rather, Applicants respectfully submit the amine and/or nitrile is an additive in solution.

Moreover, Applicants respectfully submit Kuzmina et al. teaches away from using the presently claimed solution comprising a silver precursor, an amine and/or a nitrile, and a solvent. As discussed above, Kuzmina et al. teaches that *loss of diisopropylamine molecules from the complexes is undesirable* because it leads to the formation of silver pivilate. The use of silver pivilate in silver film deposition is problematic. Due the polymeric structure of silver pivilate, it has a rather high temperature of sublimation and its sublimation is accompanied by partial decomposition. Section 3.3 and conclusion. Silver pivilate is also practically insoluble in common organic solvents. Section 3.1. Accordingly, Applicants respectfully submit Kuzmina et al. teaches away from using a solution wherein the diisopropylamine is not complexed with the silver pivilate, like the presently claimed solution comprising a silver precursor, an amine and/or nitrile, and a solvent.

Furthermore, Applicants respectfully submit Kuzmina et al. does not disclose or suggest that the *percentage by volume of the amine and/or the nitrile in the solvent is more than 0.1%* as recited in independent claim 1. Kuzmina et al. states that “[t]he solution of these *complexes* in organic solvents can be used in different varieties in CVD techniques.” Section 3.4 (emphasis added). However, as the Examiner admits, the Kuzmina et al. does not disclose a percentage of diisopropylamine that is lost from the complex to the solution.

Office Action at page 3. The Examiner alleges “it would have been obvious to use solutions containing at least 0.1% amine in solution with an expectation of their being operable for forming the silver film.” Office Action at pages 3-4. Applicants respectfully, yet strenuously, disagree. As discussed above, Kuzmina et al. teaches away from using a solution wherein the diisopropylamine is not complexed with the silver pivalate. Kuzmina et al. certainly does not disclose or suggest any particular percentage by volume of diisopropylamine in solution that is acceptable or operable. In contrast, the presently claimed process is directed to the “suitable selection of reagents making possible the dissolution of a silver precursor in a solvent that can be used in CVD.” Specification at page 2.

Applicants respectfully submit Kuzmina et al. does not disclose or suggest that the **concentration of the silver precursor in the solution is between 0.01 and 0.6 mol/l**. The Examiner cites Section 2.2.1 as disclosing a concentration of silver precursor in the solution between 0.01 and 0.6 mol/l. Office Action at page 3. However, Section 2.2.1 is directed to the synthesis silver pivalate in a water. This silver pivalate in water solution does not include an amine and/or a nitrile. In contrast, the presently claimed solution comprises a silver precursor, an amine and/or a nitrile, and a solvent. Accordingly, the concentration of silver precursor discussed in Section 2.2.1 of Kuzmina et al. is not the same as the presently claimed concentration of silver precursor.

Additionally, Applicants respectfully submit Kuzmina et al. does not disclose or suggest carrying out chemical vapor deposition, **in an oxygen atmosphere or in a hydrogen atmosphere**, of a solution comprising a silver precursor, an amine and/or a nitrile, and a solvent. Kuzmina et al. uses a solution of silver pivalate-diisopropylamine complex in organic solvent to dope a SrS film. Section 3.5. The purge and the carrier gas was nitrogen. Section 2.1. Applicants respectfully submit process utilizing a nitrogen atmosphere is significantly different from a process utilizing an oxygen atmosphere or a hydrogen atmosphere.

In the Office Action, the Examiner alleged the combination of Kuzmina et al. and U.S. Patent No. 6,613,924 (“Welch et al.”) rendered claim 10 obvious. The subject matter of claim 10 has been incorporated into independent claim 1. Applicants further respectfully

submit the combination of Kuzmina et al. and Welch et al. does not render independent claim 1, as amended, obvious.

Welch et al. discloses organosilver complexes with β -diketonates and neutral coordinating ligands are useful as silver precursors in chemical vapor deposition processes. The β -diketonates include 1,1,1,5,5,5-hexafluoro-2,4-pentanedionate (hfac), acetylacetone (acac), 2,2,6,6-tetramethyl-3,5-heptadionate (tmhd), 1,1,1,-trifluoro-2,4-pentanedionate (tfac), 2,2,7-trimethyl-3,5-octanedionate (tmod), 1,1,1-trifluoro-5,5-dimethyl-2,4,-pentanedionate (tfh), and 1,1,1,2,2,3,3,7,7,8,8,9,9-tetradecafluoro-4,6-nonanedionate (tdf). Neutral coordinating ligands include triphenylphosphine, tributylphosphine, pyridine, tetramethylethanediamine (TMEDA) and tetramethylpropanediamine (TMPDA). Abstract. The carrier gas used during chemical vapor deposition may be reactive or inert. Examples of reactive gases include hydrogen, oxygen, ozone, nitrogen dioxide, water vapor, ammonia and hydrogen sulfide. Col. 4, lines 61-62. A reducing atmosphere with hydrogen as the reactive gas is typically used for deposition of layers containing metals, for example, copper metal. Where the decomposition is carried out under an oxidizing atmosphere, for example, one containing oxygen, nitrogen dioxide or ozone, layers containing the metal in the form of an oxide are formed. Col. 5, lines 5-11.

Welch et al. is merely cited for its hydrogen reducing atmosphere and its oxygen oxidizing atmosphere. Office Action at page 6. As cited, Welch et al. does not correct the many above-noted deficiencies of Kuzmina et al.

Additionally, even though the combination of Kuzmina et al. and Welch et al. does not disclose or suggest each and every element of independent claim 1, Applicants respectfully submit one of ordinary skill in the art would not have been motivated and would not have had a reasonable expectation of success in using the chemical vapor deposition method of Kuzmina et al. in the chemical vapor deposition method of Welch et al. As discussed above, the silver precursors of Welch et al. are organosilver complexes with β -diketonates and neutral coordinating ligands. The silver precursors of Kuzmina et al. are silver pivalate and silver pivalate complexes. Silver pivalate is in the form of a dimeric having low volatility so that the deposition rate should be low. S. Samoilov et al., Chemical Vapor Deposition, 2002, 8, No. 2, p. 74-78, a copy of which is attached. Accordingly, one of ordinary skill in the art would not have been motivated or have had a reasonable expectation

of success in replacing the organosilver complexes of Welch et al. with the silver pivalate precursors of Kuzmina et al. in the chemical vapor deposition process of Welch et al.

For at least the reasons discussed above, withdrawal of the obviousness rejection of claims 1-3, 5, and 8-9 over Kuzmina et al. is respectfully requested.

Claim 4 stands rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Kuzmina et al. and further in view of U.S. Patent Application Publication No. 2003/0116091 (“Grant et al.”). Applicants respectfully disagree with this rejection; therefore, this rejection is respectfully traversed.

Grant et al. is merely cited for disclosing use of metal carboxylates as MOCVD precursors and xylene as a solvent to carry metal carboxylates. Office Action at page 5. As cited, Grant et al. does not correct the many above-noted deficiencies of Kuzmina et al.

For at least the reasons discussed above, withdrawal of the obviousness rejection of claim 4 over Kuzmina et al. in view of Grant et al. is respectfully requested.

Claims 6 and 10 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Kuzmina et al. and further in view of U.S. Patent No. 6,613,924 (“Welch et al.”). Applicants respectfully disagree with this rejection; therefore, this rejection is respectfully traversed.

Regarding claim 6, Welch et al. is merely cited for the use of diamines as stabilizing ligands for silver precursor compositions. Office Action at page 5. As cited, Welch et al. does not correct the many above-noted deficiencies of Kuzmina et al.

The subject matter of claim 10 has been incorporated into independent claim 1 and claim 10 has been cancelled. Thus, the rejection of claim 10 is now moot.

For at least the reasons discussed above, withdrawal of the obviousness rejection of claims 6 and 10 over Kuzmina et al. in view of Welch et al. is respectfully requested.

Claim 7 stands rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Kuzmina et al. and further in view of U.S. Patent No. 5,722,184 (“Onoe et al.”). Applicants respectfully disagree with this rejection; therefore, this rejection is respectfully traversed.

Onoe et al. is merely cited for forming a metalorganic gasified solution by passing gasified acetonitrile over a solid metalorganic reagent to form a metalorganic compound which is coordinated with the acetonitrile and deposited on a substrate to form a silver film. Office Action at page 7. As cited, Onoe et al. does not correct the many above-noted deficiencies of Kuzmina et al.

For at least the reasons discussed above, withdrawal of the obviousness rejection of claim 7 over Kuzmina et al. in view of Onoe et al. is respectfully requested.

Claim 11 stands rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Kuzmina et al. and further in view of U.S. Patent No. 4,703,028 (“Steininger”). Applicants respectfully disagree with this rejection; therefore, this rejection is respectfully traversed.

Steininger is merely cited for the deposition of transition metal oxides by using either a traditional MOCVD method or a cold plasma-supported CVD method. Office Action at page 7. As cited, Steininger does not correct the many above-noted deficiencies of Kuzmina et al.

For at least the reasons discussed above, withdrawal of the obviousness rejection of claim 11 over Kuzmina et al. in view of Steininger is respectfully requested.

Conclusion

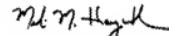
Without conceding the propriety of the rejections, the claims have been amended, as provided above, to even more clearly recite and distinctly claim Applicants' invention and to pursue an early allowance. For the reasons noted above, the art of record does not disclose or suggest the inventive concept of the present invention as defined by the claims.

In view of the foregoing remarks, reconsideration of the claims and allowance of the subject application is earnestly solicited. In the event that there are any questions relating to this application, it would be appreciated if the Examiner could telephone the undersigned attorney concerning such arguments so that prosecution of this application may be expedited.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #104003.B130130).

Respectfully submitted,

October 3, 2008


Melissa M. Hayworth
Registration No. 45,774

CROWELL & MORING LLP
Intellectual Property Group
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844
EJG:MMH